

Practical Micromechanics of Composite Materials

MATLAB Quick Start Guide

This guide is for the MATLAB scripts and functions that accompany the book *Practical Micromechanics of Composite Materials*, by Aboudi, Arnold, and Bednarczyk. These scripts and functions are used in most of the examples and exercises in the book, and detailed descriptions of the MATLAB functionality and application are provided therein. The basics of the MATLAB code are described in Section 1.3 of the book, while additional features are detailed in the appropriate subsequent chapters.

The entirety of the MATLAB code is available from: <https://github.com/nasa/Practical-Micromechanics>

A. There are **three primary use cases for the MATLAB code**, as enumerated below:

1. Laminate analysis using effective ply properties:

- Each laminate problem is defined in the function `LamProblemDef.m`
- The ply-level material properties are specified in the function `GetPlyProps.m`
- Analysis is performed by executing the script `LamAnalysis.m`

2. Stand-alone micromechanical analysis of composite materials:

- Each micromechanics problem is defined in the function `MicroProblemDef.m`
- The constituent material properties are specified in the function `GetConstitProps.m`
- The micromechanics-based composite materials are defined in `GetEffProps.m`
- Thermoelastic analysis is performed by executing the script `MicroAnalysis.m`
- **Progressive damage simulations** are performed by executing the script `MicroSimDamage.m`

3. Multiscale laminate analysis using plies that are represented with micromechanics:

- Each multiscale laminate problem is defined in the function `LamProblemDef.m`
 - The plies are simply assigned micromechanics-based composite materials in this case
- The constituent material properties are specified in the function `GetConstitProps.m`
- The micromechanics-based composite materials are defined in `GetEffProps.m`
- Thermoelastic analysis is performed by executing the script `LamAnalysis.m`
- **Progressive damage simulations** are performed by executing the script `LamSimDamage.m`

B. Two additional MATLAB functions frequently require user interaction for cases involving micromechanics (both stand-alone micromechanics and multiscale laminate analysis):

1. **Functions/Micromechanics/GetRUC.m**: Used to control options of the geometric repeating unit cells (RUCs) used by the GMC and HFGMC micromechanics theories (Chapters 5 – 7)
2. **Functions/WriteResults/PlotMicroFields.m**: Used to control options for pseudocolor plots of the local stress and strain fields predicted by micromechanics (e.g., scale min and max)

C. Finally, **results** for all problems are written to files in the `Output` directory (text, Word, graphics).